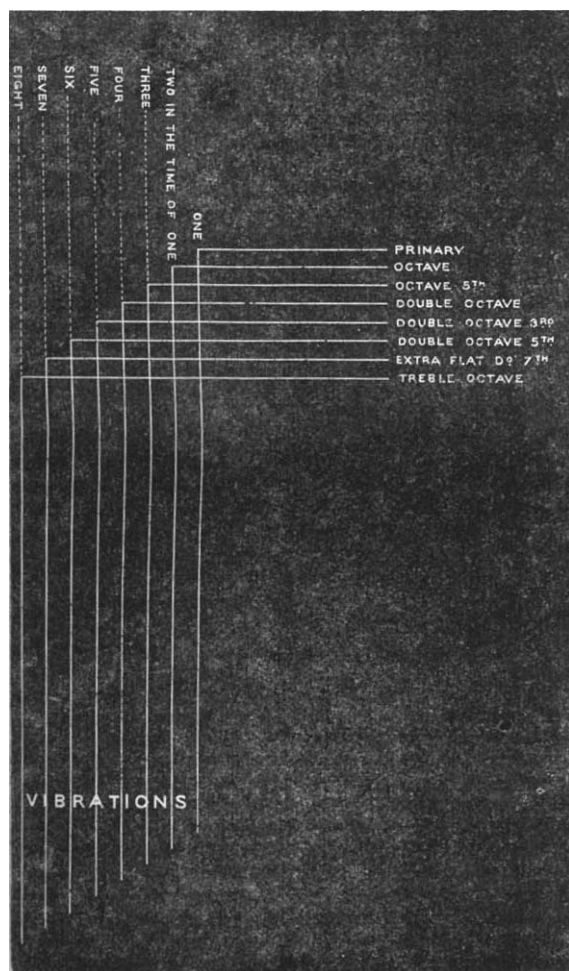


ear, retain impressions made upon them for a momentary period after the cause has ceased to act. If this surmise is correct, then the following would ensue. All musical tones being produced by vibrations striking upon the ear in rapid succession, the first vibration would continue to be felt during the strokes of a number of succeeding vibrations.

The second vibration coming upon the ear before the first ceased to be felt would produce the effect of two in the time of one, making the octave sound.

The third would produce the effect of three in the time of one, making the octave fifth; the fourth, four in one, the double octave; the fifth, five in one, the double octave third, and so on,



the order exactly corresponding with that in which the partials are heard.

Of course while the successive strokes occur the first is becoming fainter in effect, and thus each partial in the above order is heard with fainter intensity.

What the first vibration is to the second and its successors the second vibration is to the third and its successors, and thus the series of partials is kept up as long as the primary tone exists. This also accounts for the strong partials heard in the rough vibrations of the harmonium and the few partials heard from the smooth tones of the flute.

W. C. JONES

Chester, October 18

The Green Sun

ON Sunday, September 9, the residents in Colombo, while enjoying their evening stroll on Galle Face, were astonished by a strange appearance in the heavens. The sky was cloudy, and frequent squalls were passing over the sea, one of which just

touched Colombo. As soon as it was past, the sun emerged from behind a cloud, of a bright green colour. It was then about 10° above the visible horizon. The whole disk was distinctly seen, and the light was so subdued that one could look steadily at it; indeed I should say its intensity was scarcely half that of the full moon. The same phenomenon was also observed on Monday and Tuesday. Wednesday was overcast, and I have not heard of any observations being made; and on Thursday the sun had resumed its normal appearance. I was not in a position to observe it in the morning; but from reports from other parts of the island I learn that the sun appeared green at its rising, and afterwards changed to blue, like the flame of sulphur, giving little light till it had attained an altitude of about 20° , when it could no longer be watched with the naked eye. During the day the light had a bluish tinge; and in the evening the same phenomena were repeated in inverse order. The moon also, to some extent, was affected in the same way.

Can any of your correspondents give an explanation of this? It has been suggested that a convulsion in the sun may have given prominence to vapours emitting a green light; but to me it seems more probable that the cause is to be sought in the upper strata of the earth's atmosphere. Can it have any connection with the recent volcanic eruption in the Straits of Sunda?

Colombo, September 19

W.

IN a clear sky, as the disk of the sun sinks down beneath the horizontal line of the ocean, the parting ray is a brilliant emerald green. I have occasionally, but not often, had the pleasure of seeing this interesting phenomenon, as the clear atmosphere has to be accompanied with a cloudless region of the sky where the sun is setting. The same effect is not produced by the sun setting behind a distant bank of clouds. Probably the first ray from the rising sun would be the same unexpected colour.

Week St. Mary Rectory, Cornwall

G. H. HOPKINS

Pons' Comet

THIS comet already has a tail, though a very faint one. With a $4\frac{1}{4}$ -inch refractor I traced it last night to a distance of $20'$ from the nucleus, at a position angle of about 75° .

October 26

T. W. BACKHOUSE

Earthquake

SEEING in your last issue (vol. xxviii. p. 623) that Mr. Cecil describes two distinct tremors of earthquake felt here by him, I write to say that the same phenomena were experienced by myself. I was disturbed in the night by what I mistook for an alarm going off, but found that it was a glass on my water-bottle vibrating violently. After a short pause the glass again vibrated. I found next morning that I could exactly reproduce this sound by shaking the washing-stand. I have never known the washing stand to tremble before, even in a gale.

H. HOWARD CRAWLEY

Pine View, Bournemouth, October 29

STUDIES MADE ON THE SUMMIT OF THE PIC DU MIDI WITH A VIEW TO THE ESTABLISHMENT OF A PERMANENT ASTRONOMICAL STATION¹

THANKS to the indefatigable zeal of General de

Nansouty and the engineer Vaussenat, a meteorological observatory has already been erected on the Pic du Midi. After visiting the place with the Director of the Higher Instruction on the occasion when this observatory was handed over to the State, Admiral Mouchez came to the conclusion that it might be possible to establish an unrivalled astronomical station on the summit, which is now perfectly habitable. In the month of August last he did us the honour of requesting us to study on the spot the advantages and possible drawbacks attending an installation made under such exceptional conditions. The details of our observations will form the subject of a special memoir far too extended for insertion in the *Comptes Rendus*. For the present our remarks must

¹ Note by MM. Thollon and Trépied, from *Comptes Rendus* of October 15.

be limited to a simple communication of the more interesting results obtained by us from August 17 to September 22.

On reaching the summit of the Pic du Midi (2877 metres), where the barometer maintains a mean height of 538 mm., everything presents itself to the observer as if the density of the veil formed above him by the atmosphere were diminished by about a third. The aerial region left behind him being unquestionably the most charged with mist, dust, and aqueous vapour, he may expect to find at once more light and less diffusion. Thus, during the mornings of September 19 and 20, by masking the sun with a screen held at some distance, and exploring the surrounding space with a small spectroscope with an aperture of 0.02 m., we were able to observe the planet Venus at a distance of 2° from the solar disk. We could even subsequently distinguish it with the naked eye. But what most surprised us was the marvellous definition at this station. The limb of the sun projected on the slit of a spectroscope showed a spectrum with a boundary as sharp as if produced by a punching machine. We can positively state that we never elsewhere saw anything similar either at Nice, in Italy, Algeria, or even Upper Egypt. We should add that this complete absence of undulation was noticed only in the morning. After the slopes of the mountains had been exposed for several hours to the heat of the sun, the undulations were produced as they are everywhere else, and even became excessive for the rest of the day.

During clear nights, using a telescope with an aperture of 0.16 m., and a reflector by Henry of 0.20 m., we found the perfect definition observed in the case of the sun in the morning reproduced in the case of the moon, planets, and stars. Under such conditions observations of extreme precision could certainly have been obtained.

For the study of solar physics we had set up the horizontal telescope and the large spectroscope which we usually employ. On observing the solar spectrum at a favourable moment, it seemed streaked in its entire length with a considerable number of fine lines, some bright, others dark, at a mean distance of 3" of arc from each other. They certainly belonged to the solar image, for they followed all its displacements, and they could have arisen from the granulations of the photosphere alone. Under the same conditions, that is, when the images were perfectly still, the hydrogen bands C and F had no longer any sort of continuity, but seemed formed of distinct bright and dark fragments, of the same magnitudes as the intervals between the lines.¹ This phenomenon was observed not merely at certain times and places, but constantly over the whole surface of the disk. We feel satisfied that the chromosphere presents a system of granulations analogous to that of the photosphere. The two systems thus superimposed become separated in the spectroscope, yielding, one a continuous, the other a linear, spectrum, and blending together in the telescope as on a photographic proof. If this chromosphere, thus rendered visible on the full disk, happened to be traversed by a protuberance, the band C increased in luminosity and for a greater length. By giving sufficient breadth to the aperture, we were then able to observe the protuberance itself, as when on the edge, although naturally with less brilliance, and foreshortened. Nor is this the first instance of protuberances thus observed on the full disk. On this subject the delicate observations of Young and Tacchini are well known. But instead of being accidentally visible, instead of being produced only under special circumstances, as for instance in the neighbourhood of a spot or on the bridge of a spot in process of segmentation, these phenomena were constant for us with varying degrees of intensity, and under the sole condition of using an image entirely free from undulations.

These phenomena referred to by Messrs. Thollon and Trépid were observed and recorded in England under exceptionally fine atmospheric conditions during the last sunspot maximum.

The observations made outside the edge of the solar disk were no less pregnant with results. We know that in the spectrum of the chromosphere there are eight lines always visible under ordinary conditions. On the Pic du Midi, during the five days when we were able to make our records at favourable moments, we saw the number of these bright lines always visible increased to over thirty in the portion of the spectrum which is comprised between D and F. Here we subjoin a table of the wavelengths of these lines :—

5533.6	5273.2	5204.8	5122.6
5525.8	5258.9	5199.5	5114.4
5469.9	5254.3	5196.9	5112.1
5361.5	5252.2	5183.0	5087.0
5324.3	5248.8	5172.0	5029.8
5318.7	5233.9	5168.3	5017.9
5292.4	5225.6	5166.7	4983.6
5283.1	5207.4	5147.0	4923.0
5275.0	5206.8	5130.2	4882.9
			4854.2

It will be seen that, at the altitude at which our observations were made, an approach was made to the conditions prevailing during a total eclipse.

To resume. The observations we were able to make on the Pic du Midi during the five weeks of our sojourn on its summit justify us in concluding that science will gain much by the completion of the astronomical station begun by the directors of the Paris and Pic Observatories. Here we should have a permanent establishment always open to *savants* wishing to undertake special researches. To mention those points only towards which our attention was mainly directed, we are of opinion that good opportunities would here be found of furthering the solution of many problems connected with solar physics and the spectral analysis of the stars.

THE WHEAT HARVEST OF 1883

THE public must be somewhat puzzled with the divergent opinions of authorities upon the yield of the wheat crop of the present year. On the one side, for example, stands Sir John Lawes with his accurate balances and wonderful wheat field, which experience has taught him usually proves a fair criterion of the yield of the English crop. On the other side is arrayed a somewhat formidable party, which we may take as well represented and led by the very able article in the *Times* of Saturday last, headed "The Result of the Harvest." To put the matter briefly, there is a difference of opinion as to whether we have reaped an average crop or an under-average crop of wheat. And there is also a good deal of difference in opinion as to what an average crop is. The point of greater interest no doubt to us is whether we have just secured an abundant harvest or not. It is a point of very great importance not only intrinsically but as a matter of opinion. If business men believe that our national wealth has been recently increased by an unusual augmentation of our food supply, they may make this opinion a basis for enterprise or speculation. If the opinion which prompted them to action should prove a false one, the results would be inflation, panic, and loss. It is therefore very essential that public opinion should be guided in a right direction upon this important point. Any person who has read our leading newspapers carefully upon the subject of harvests for a series of years will probably have observed a tendency to over-estimate production. The prospect is usually depicted *couleur de rose*, and the public is congratulated upon its harvest prospects, while practical farmers remain in doubt as to the yield of their cornfields. Of one thing we may be certain—that wheat needs heat. The average temperature of our islands is scarcely suitable to the wheat plant, which is rightly viewed as somewhat exotic in its requirements. A slight elevation above the sea-level, or a slight decrease in solar heat, invari-